APPENDIX A

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 9
OFFICE OF POLICY AND MANAGEMENT
HEALTH AND SAFETY OFFICE

SITE SAFETY PLAN
FOR
HAZARDOUS SUBSTANCES RESPONSE AND FIELD INVESTIGATIONS

I. DESCRIPTION OF FIELD ACTIVITY:

Site: Bluewater Uranium Mine Sites Site Phone: N/A

Location: 5 miles West of Prewitt, NM SUPERFUND: Yes ___ No _X_

SSP Prepared By: Robert Bornstein Mail Code (H-8-3) Phone 4-2298

Proposed Date of Response/Investigation: August 1 - August 21, 1991

Purpose/Objective: Response Action at the Brown-Vandaver-Nanabah Site and Desiderio Mine Sites to eliminate excess gamma radiation and radon gas emissions.

Background Review: Complete _____ Preliminary __X__

Background Material Attached: Yes _X__ No _____

Indicate which of the following information source(s) were consulted: State and/or Local Agency, State and/or Federal OSHA, NIOSH, EPA files, Site Operator and Local Fire Department. ATSDR Health , OSHA NRC Regulations.

Overall Hazard Summary: Low _____ High _____

Medium __X___ Unknown _____

Route of Exposure: Inhalation _X__ Skin Contact ___ Ingestion _X_

Map or Sketch Attached: Yes ___ No _X__

Direct Gamma Exposure X

MSB

II. SITE CHARACTERISTICS:

A. Facility Description: The sites consist of two abandoned uranium strip mines. Features include large open pits, overburden and protore piles and rocks.

B. Hazardous Substance(s) Description: Uranium isotopes, radium-226, radon-222, gamma radiation. Hazardous substances associated with this site include gamma radiation (as high as 1200 uR/hr), uranium decay daughters such as radium-226. The gamma radiation is considered to be an exposure hazard after spending 2-3 hours a day within the field for approximately 300 days out of year. Ingestion of alpha emitting particles is known to cause damage to internal organs.

C. Status: Active _____ Inactive __X__ Unknown _____

III. HEALTH AND SAFETY CONSIDERATIONS:

Hazard Assessment[1] (Toxic effects, TLV, odor threshold, reactivity, stability, flammability, and operational hazards with sampling, decontamination, etc.):Constant or frequent exposure to elevated gamma radition is known to cause cancer, life span shortening and cataracts. The inhalation of radionuclides exposes internal organs to damaging alpha particles. Uranium and several of its decay daughters are alpha radiation emitters. Once ingested, the alpha particle is trapped within the body and can cause severe organ damage and genetic defects. Radiation is a known carcinogen, mutagen and teratogen.

Areas of Concern[2]	Hazard Potential[3]	Precautions
Explosion:	LOW	
Oxygen Deficiency: (e.g. Confined Spaces)	LOW	
Radiation:	MEDIUM	Level C proclo
Toxic Gases: a. General (HNU meter)	LOW	
b. Specific: (e.g., Sorbent or Detector Tube)	LOW	
Skin/Eye Contact:	MEDIUM	Tyvek Clothing
Heat Stress:	HIGH	Will take breaks and monitor
Falling Objects: (e.g. stacked barrels, etc.)	LOW	
Falls: (e.g. pits, ponds, elevated work places, etc.)	HIGH	Hazards will be delineated and marked
Confined Spaces: (e.g. manholes, vaults, closed rooms, trenches, etc.)	LOW	

IV. WORK PLAN INSTRUCTIONS:

Hazardous Substance Sampling and Field Investigations

A. Level of Protection: A ___ B ____ C _X_ D ____

Modifications: Level C = Full face respirators, tyvek, boot covers and tape. Respirators will not be required inside self-contained air equipment cabs.

Surveillance Equipment and Materials: Dust meter, radiological instruments to monitor radiation.

B. Entry Procedures: All personnel will attend morning site safety meetings. A staging zone will be delineated and personnel will dress in protective clothing and enter the site. A medical monitoring program to prevent heat stress will be undertaken. All personnel will have appropriate radiological health and safety training and have read the approved Health and Safety Plan.

C. Field Investigation and Decontamination Procedures:
Perimeter Establishment: Zones of Contamination Identified? Yes

Public Perimeter Identified? YES Map/Sketch Attached? NO

Notes:Hot zones will be established. At this time EPA is planning to delineate all areas exceeding 165 uR/hr above background will be designated "Hot" and require response action. During earthmoving activities, the hot zone will be expanded to include all areas being effected by heavy dust. Water will be used as dust control.

Team Make-Up: EPA _3_ FIT ___ TAT ___ CG _1__ STATE _8_ OTHER ____

Station Designation (Name/responsibility):
1. Robert Bornstein, OSC
2. Art Ball, ERT- Health Safety Officer
3. Neil Kasper, Laguna Construction Project Manager

Work Schedule/Limitations: Work will be conducted from 6:00 am to 4:30 pm with a half hour lunch. Several 20 minute breaks will be held during the day to prevent heat stress.

Hot Line Location (initial): Areas emitting 165 uR/hr above background.

Command Post - Location (initial): Staging zone at Brown -Vandever Home.
- Radio Call Sign: _____
- Frequency/Channel: _____

Equipment and Materials/Special Facilities: _____

_____

_____

Decontamination Procedures (contaminated protective clothing, instruments, equipment, etc.): All outer protective clothing will be screened for radiological contamination. Members will strip outer gear. If radiation is detected gear will be scrubbed and bagged as radiological waste. Members will shower, and wash prior to leaving site.

Disposal Procedures (contaminated equipment, supplies, disposal items, wash water, etc.): A dry decontamination process will be used. All outer wear will be screened for radiation. From the data collected during EPA's assessment, it is highly unlikely that any radioactive contaminated waste will be produced and require special disposal.

V. EMERGENCY PRECAUTIONS:

Acute Exposure Symptoms

Agent	Symptom	First Aid
URANIUM ISOPTOPES	GI UPSET > 200R	WASH Exposed SKIN MONITOR FOR EXPOSURE

IT IS HIGHLY UNLIKELY THAT ANY PERSONNEL WILL BE EXPOSED TO ANY ACUTE EXPOSURES. TO PREVENT CHRONIC OR LONG TERM HEALTH PROBLEMS THE FOLLOWING PRECAUTIONS WILL BE UNDERTAKEN:

THERMOLUMINESCENT DOSIMETERS (TLD)

TLDs will be provided to employees who will be working at the Site. Instructions on the use and care of the TLD will be given at the time of issuance.

The TLDs will be read on a quarterly basis and/or at the end of the site action. All EPA personnel Exposure reports will be sent to the Region 9 Regional Office of Radiation Programs for evaluation. A copy will be sent to the Health and Safety Office for inclusion in the individual's medical monitoring files.

PERSONNEL RADIATION EXPOSURE

Pocket doismeters will be issued when entering the site as described in the Site Entry section. A Personnel Radiation Exposure Log will be kept for EPA personnel entering the Site. A copy of this will be forwarded to the Health and Safety Officer at the end of the Preliminary Assessment.

ACCESS CONTROL

Although no elevated gamma concentrations were detected during the assessment greater than 1200 uR/hr, access to any areas emitting >2.5 mR/hr will be strictly forbidden, unless under direct supervision of radiation protection personnel. (MSB)

A Site "~~High~~ Radiation Area" will be delineated for all areas exceeding 2 mR/hr. (MSB)

AIR MONITORING

Air monitoring will be conducted using a portable dust meter. Although the meter does not specifically detect radiation, the amount of dust emitted during site operations will be monitored. Air monitoring for radionuclides will be conducted if deemed appropriate by site radiation protection personnel. (MSB)

ATTACHMENTS

General Survey Guidelines
Background Measurements
Alpha, Beta and Gamma Radiation Measurement Procedures
Personnel Decontamination Procedures

EMERGENCY

A. Nearest Hospital Emergency Room. Note: for remote locations, give directions to hospital and attach map.

NAME: Lovelace Medical Center
ADDRESS: 5400 Gibson Blvd. SE., Albuquerque, NM 87108
PHONE: 505-262-7222
Cibola – 1212 Box 1TA Grants

B. Emergency Services (Telephone Numbers)

1. FIRE 911

2. POLICE 911

3. AMBULANCE 911

C. Poison Control Center of San Francisco
Toxic and Hazardous Chemicals: 415-476-6600 (24-Hr.)

D. Regional Health and Safety Office: 415-744-~~1607 or~~ -1606

E. Regional Radiation Representative: 415-744-1048

F. Office of Radiation Programs, Las Vegas Facility (ORP-LVF):
702-798-2476 FTS 545-2476

APPROVALS:		Date:
Project Team Leader:	Robert Barnett	7-26-91
Supervisor:	Dimitri Kanas	7-26-91
Health and Safety Office:	Richard Tafoya	7-31-91
Radiation ERT Health Radiation Officer	Patti C Ball	8-13-91
Region IX Radiation Office	Michael S. Barr	8-1-91
NSP	Patrick Hickey	8-13-91
NSP	Stanley Ehrlich	8-13-91
Weston/REAC	Gerald Hola	8/13-91
Weston/REAC	Kai Mueller	8/13/91
EPA R9	Stephen Nelson	8/13/91

B.1 GENERAL SURVEY GUIDELINES

The following are general guidelines designed to aid in the development of survey planning for indoor or outdoor areas.

1. Covering an Area

   a. Gridded areas (either land or other surfaces) are traversed one grid block at a time.

   b. Ungridded areas (either land, equipment or other surfaces) are traversed in an orderly manner using colored flags or markings, if necessary, to indicate survey progress and prevent inadvertent re-surveying.

2. Scanning vs. Discrete Measurements

   a. Scanning is performed by moving a detector at a slow rate over as much surface area as possible and noting changes in count rate. While scanning, the detector is held as close to the surface as possible without contact; this distance is carefully maintained for the duration of scanning as fluctuating distances result in inaccurate data. Discrete measurements are taken with the detector held in place at a specified distance from the surface.

   b. For gridded areas that are too large for continuous scanning to be practical, discrete measurements may be taken at specified grid block areas such as at each corner, in the center and at major grid points. The exact locations are determined by the survey plan.

   c. For ungridded areas that are too large for continuous scanning to be practical, discrete measurements may be taken at intervals or locations as specified by the survey plan, and carefully referenced to the site map.

   d. Discrete gamma scintillation detector measurements are generally made both at the surface and at one meter above the surface.

   e. When scanning indicates elevated radiation levels, discrete gamma scintillation, G-M and exposure rate measurements are generally made at these locations (and of the immediate surrounding area for contamination determinations).

   f. Prominent surface features noted while scanning should be indicated on the site map and referenced to the corresponding grid block, where appropriate.

   g. Due to the relatively short range of alpha and beta particles, scanning intervals for detection of these particles should be close or even overlapping. The scanning interval for gamma radiation may range from .5 to 5m depending on the site

radiological history, contamination potential, and other survey findings.

3. Other Measurement Practices

   a. When G-M (pancake detector) measurements indicate readings of twice background or more, the shield may be used for beta-gamma discrimination measurements.

   b. Elevated radiation areas, either outdoor or indoor, should be indicated by appropriate markings (survey flags, tape, grease pencils).

   c. When indoor surfaces are surveyed, particular attention should be given to cracks, joints, openings in floors and walls, ledges, ducts, drains and other locations where material may have accumulated.

   d. Average radiation values for an area may be determined for either direct or indirect (swipe) radiation measurements. Average values are generally appropriate for areas of consistent radiation levels or contamination, although they have other applications, as specified in the survey plan.

4. Transferable Contamination

   a. In gridded areas, at least one smear sample per grid block should be taken, preferably at a location showing an elevated radiation level.

   b. In ungridded areas, the number and location of smear samples is determined by the results of scanning or discrete measurements, and by the size of the area.

   c. Smear samples should be taken at all locations of elevated radiation levels as identified by scanning. Smear samples taken of the immediate surrounding area may be helpful in defining the extent of contamination.

   d. Smear samples cover 100 cm^2 of surface, and are generally taken from the center of a particular area to be tested. Typically, a 100 cm^2 sample is taken per each 100 ft^2 (or each 10 m^2) of surface.

B.2 BACKGROUND MEASUREMENTS

1. Purpose

The purpose of this procedure is to describe the technique for obtaining background radiation measurements.

2. Applicability

This procedure applies to all radiation measurements and surveys; background radiation levels serve as a base line for comparison purposes.

3. Equipment

Basic:

a. Micro R meter

b. Gamma check source

c. Headphones, if desired

d. Survey forms

Site specific:

a. Survey ratemeter or scaler/ratemeter

b. NaI gamma scintillation detector

c. Pancake G-M detector

d. ZnS alpha scintillation detector

e. Alpha and beta-gamma check sources

f. Ion chamber

Standard background measurements are taken with a micro R meter. Background measurements are additionally taken with any instruments that are involved in a radiation survey.

4. References

a. B.1 General Survey Guidelines

b. B.6 Gamma Exposure Rate Measurement

c. B.5 Gamma Radiation Measurement

d. B.4 Beta-gamma Radiation Measurement

e. B.3 Alpha Radiation Measurement

f. Instrument operation manuals

5. Operational Check

Refer to procedure B.6 for operational check instructions pertaining to the micro R meter. Procedures B.5, B.4, B.3 and B.6 contain operational check instructions for the NaI detector, pancake G-M detector, ZnS detector and ion chamber, respectively, should these procedures need to be performed for background measurements on a site specific basis.

6. Procedure

a. Locate appropriate background sites. Background sites are typically "undisturbed" areas (i.e. unaffected by radioactivity from the candidate site, from nearby building materials with high natural levels of uranium and thorium, from fertilizers, etc.) upwind of the candidate site at a distance of at least one mile.

b. Refer to procedure B.6 for measurement procedures pertaining to the micro R meter. Procedures B.5, B.4, B.3 and B.6 contain measurement procedures for the NaI detector, pancake G-M detector, the ZnS detector and the ion chamber, respectively, should these procedures need to be performed for background measurements on a site-specific basis.

c. Take measurements at four or five background locations. Micro R meter measurements (μR/hr) and ion chamber measurements (mR/hr) are taken one meter above the surface; NaI detector measurements (cpm) are taken at the surface and one meter above the surface; ZnS detector and pancake G-M detector measurements (cpm) are taken as close to the surface as possible without contact.

d. If a scaler is used, background measurements are preferably taken for the same amount of time as survey measurements.

e. Record background measurements on the appropriate survey form and in the field logbook.

B.3 ALPHA RADIATION MEASUREMENT

1. Purpose

The purpose of this procedure is to describe the method for measuring alpha radiation levels over ground and on equipment and other surfaces.

2. Applicability

This procedure applies a) when alpha-emitting radionuclides are suspected, b) in locations where gamma or beta-gamma levels are elevated, c) when determining contamination levels of equipment and other surfaces.

3. Equipment

a. Survey ratemeter or scaler/ratemeter

b. ZnS alpha scintillation detector

c. Alpha check source

d. Headphones, if desired

e. Radiation Survey Data form, Radiation Contamination Survey Summary form

4. References

a. B.1 General Survey Guidelines

b. B.2 Background Measurements

c. Appendix C Reference Grid System Procedure

d. Instrument operation manuals

e. Table 19-4 (Section 19 of this manual) Acceptable Contamination Limits

5. Operational Check

a. Adjust high voltage if necessary; attach ZnS detector to ratemeter.

b. Perform a battery check.

c. Inspect instrument for a current calibration label.

d. Record the background radiation measurement.

e. Set range to desired level based on previous operational check results.

f. Set response time to slow. When taking a measurement with a ratemeter, the detector is held in place long enough to accommodate the appropriate response time. If a scaler is used, count for at least one minute.

g. Check the response to the alpha check source by placing the source at the designated location on the detector. Record the net result (gross cpm - background cpm) on the Operational Check Log corresponding to the detector-ratemeter combination and compare with acceptable values. Instruments which do not respond appropriately are removed from service.

6. Procedure

a. Ensure that background measurements have been made as per Section B.2.

b. Set range to the highest level. The range will be adjusted any time a reading falls within 10% of either end of the scale.

c. Discrete measurements - Hold the detector in place as close to the surface as possible (without contact) and note the count rate.

Scanning - Pass the detector over the surface as close as possible (without contact) at a rate of 10-20 cm per second. Note increases in count rate as indicated by the audible meter output. Typically, count rates 5-10 times the background rate are indicative of contamination or radionuclide concentrations exceeding allowable levels. Discrete measurements should be made at locations showing an elevated reading.

Contamination monitoring - Scan as above, over areas of approximately 100 cm^2 at a time, and note average count rate.

d. If necessary, mark areas of increased count rate using survey flags for land areas and paint or grease pencil for other surfaces.

e. Gross measurements are recorded on the appropriate survey form. Data is corrected using either of the following, as applicable:

i) $$dpm = \frac{\text{gross counts - background counts}}{\text{time (min) x efficiency}}$$

ii) $$dpm/100\ cm^2 = \frac{\text{gross counts - background counts}}{\frac{\text{time (min) x efficiency x probe area } (cm^2)}{100}}$$

Reduced data is recorded on the appropriate survey form, and in the field logbook as specified by the team leader.

B.4 BETA-GAMMA RADIATION MEASUREMENT

1. Purpose

The purpose of this procedure is to describe the method for measuring beta-gamma radiation levels over ground and on equipment and other surfaces.

2. Applicability

This procedure applies a) when beta-emitting radionuclides are suspected, b) in locations where gamma exposure rates are elevated, c) when determining contamination levels of equipment and other surfaces.

3. Equipment

a. Survey ratemeter or scaler/ratemeter

b. Pancake G-M detector

c. Appropriate check source

d. Headphones, if desired

e. Beta shield - minimum thickness 200 mg/cm^2

f. Radiation Survey Data form, Radiation Contamination Survey Summary form

4. References

a. B.1 General Survey Guidelines

b. B.2 Background Measurements

c. Appendix C Reference Grid System Procedure

d. Instrument operation manuals

e. Table 19-4 Acceptable Contamination Limits

5. Operational Check

a. Adjust high voltage if necessary; attach pancake G-M detector to ratemeter.

b. Perform a battery check.

c. Inspect instrument for a current calibration label.

d. Record the background radiation measurement.

e. Set range to desired level based on previous operational check results.

f. Set response time to slow. When taking a measurement with a ratemeter, the detector is held in place long enough to accommodate the appropriate response time. If a scaler is used, count for at least one minute.

g. Check the response to an appropriate check source by placing the source of the designated location on the detector. Record the net result (gross cpm - background cpm) on the Operational Check Log corresponding to the detector-ratemeter combination and compare with acceptable values. Instruments which do not respond appropriately are removed from service.

6. Procedure

a. Ensure that background measurements have been made as per Section B.2.

b. Set range to the highest level. The range will be adjusted any time a reading falls within 10% of either end of the scale.

c. Discrete measurements - Hold the pancake G-M detector in place as close to the surface as possible (without contact) and note the count rate.

Scanning - Pass the detector over the surface as close as possible (without contact) at a rate of 10-20 cm per second. Note increases in count rate as indicated by the audible meter output. Typically, count rates 5-10 times the background rate are indicative of contamination or radionuclide concentrations exceeding allowable levels. Discrete measurements should be made at locations showing an elevated reading.

Contamination monitoring - Scan as above, over areas of approximately 100 cm^2 at a time, and note average count rate.

d. If necessary, mark areas of increased count rate using survey flags for land areas and paint or grease pencil for other surfaces.

e. Gross measurements are recorded on the appropriate survey form. Data is corrected using either of the following, as applicable:

i) $$\text{dpm} = \frac{\text{gross counts} - \text{background counts}}{\text{time (min)} \times \text{efficiency}}$$

ii) $$\text{dpm}/100\ \text{cm}^2 = \frac{\text{gross counts} - \text{background counts}}{\text{time (min)} \times \text{efficiency} \times \text{probe area } (\text{cm}^2)} \Big/ \frac{}{100}$$

Reduced data is recorded on the appropriate survey form, and in the field logbook as specified by the team leader.

f. The beta shield is used if discrimination between beta and gamma radiation components is desired. Count rates are noted both with and without the beta shield in place, corrected as necessary, and recorded in the field logbook.

B.5 GAMMA RADIATION MEASUREMENT

1. Purpose

   The purpose of this procedure is
   uring gamma radiation levels over
   surfaces.

2. Applicability

   This procedure applies a) when g
   suspected, b) in locations where ga
   c) when determining contamination l
   faces.

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3. Equipment

   a. Survey ratemeter or scaler/ratem

   b. NaI gamma scintillation detector

   c. Gamma check source

   d. Headphones, if desired

   e. Radiation Survey Data form, Radiation Contamination Survey Summary form

4. References

   a. B.1 General Survey Guidelines

   b. B.2 Background Measurements

   c. Appendix C Reference Grid System Procedure

   d. Instrument operation manuals

   e. Table 19-4 Acceptable Contamination Limits

5. Operational Check

   a. Adjust high voltage if necessary; attach NaI detector to ratemeter.

   b. Perform a battery check.

   c. Inspect instrument for a current calibration label.

   d. Record the background radiation measurement.

   e. Set range to desired level based on previous operational check results.

f. Set response time to slow. When taking a measurement with a ratemeter, the detector is held in place long enough to accommodate the appropriate response time. If a scaler is used, count for at least one minute.

g. Check the response to the gamma check source by placing the source at the designated location on the detector. Record the net result (gross cpm - background cpm) on the Operational Check Log corresponding to the detector-ratemeter combination and compare with acceptable values. Instruments which do not respond appropriately are removed from service.

6. Procedure

a. Ensure that background measurements have been made as per Section 8.2.

b. Set range to the highest level. The range will be adjusted any time a reading falls within 10% of either end of the scale.

c. Discrete measurements - Hold the detector in place as close to the surface as possible (without contact) and note the count rate; on land and building surfaces, additionally place the detector 1 meter above the surface and note the count rate.

Scanning - Gamma scanning of land and building surfaces is usually performed by swinging the detector in front of the body while moving forward at a slow walk. For other surfaces, pass the detector over the surface as close as possible (without contact) at a rate of 10-20 cm per second. Note increases in count rate as indicated by the audible meter output. Typically, count rates exceeding ambient levels by greater than 5,000 to 10,000 cpm are indicative of significant concentrations of radionuclides on the surface. Discrete measurements should be made at locations showing an elevated reading.

Contamination monitoring - Scan as above, over areas of approximately 100 cm^2 at a time, and note average count rate.

d. If necessary, mark areas of increased count rate using survey flags for land areas and paint or grease pencil for other surfaces.

e. Gross measurements are recorded on the appropriate survey form. Data is corrected using the following, as applicable:

$$dpm = \frac{\text{gross counts - background counts}}{\text{time (min) x efficiency}}$$

Reduced data is recorded on the appropriate survey form, and in the field logbook as specified by the team leader.

B.6 GAMMA EXPOSURE RATE MEASUREMENT

1. Purpose

The purpose of this procedure is to describe the method for measuring external gamma exposure rates in buildings and over ground surfaces.

2. Applicability

This procedure applies a) when gamma-emitting radionuclides are suspected, b) when a "radiation map" of exposure rates is required.

3. Equipment

a. Ion chamber or micro R meter

b. Gamma check source

c. Radiation Survey Data form

Ion chambers are useful for exposure rate measurements above approximately .5 mR/hr. Micro R meters are useful for approximate exposure rates between Ø and 5 mR/hr. Gamma exposure rate measurements are ideally made with a low-level pressurized ion chamber and a cross-calibrated NaI gamma scintillation detector.

4. References

a. B.1 General Survey Guidelines

b. B.2 Background Measurements

c. Appendix C Reference Grid System Procedure

d. Instrument operation manuals

5. Operational Check

a. Perform a battery check. Adjust high voltage if necessary.

b. Inspect instrument for a current calibration label.

c. Record the background radiation measurement.

d. Set range to desired level based on previous operational check results.

e. Set response time to slow. When taking a measurement, the meter is held in place long enough to accommodate the appropriate response time.

f. Check the response to the gamma check source by placing the source at the designated location on the detector. Record the

net result (gross exposure rate - background exposure rate) on the appropriate Operational Check Log and compare with acceptable values. Instruments which do not respond appropriately are removed from service.

6. Procedure

a. Ensure that background measurements have been made as per Section B.2.

b. Set range to the highest level. The range will be adjusted any time a reading falls within 10% of either end of the scale.

c. Place the detector one meter from the surface at the desired location and note the exposure rate.

d. If necessary, mark areas of elevated exposure rate using survey flags for land areas and paint or grease pencil for other surfaces.

e. Gross measurements are recorded on the Radiation Survey Data form. Data is corrected using the following, as applicable:

$$\text{Corrected exposure rate} = \frac{\text{gross exposure rate - background exposure rate}}{\text{efficiency}}$$

Reduced data is recorded on the Radiation Survey Data form, and in the field logbook as specified by the team leader.

B.8 DETERMINATION OF TRANSFERABLE CONTAMINATION (SWIPE TEST)

1. Purpose

The purpose of this procedure is to describe the method for measuring removable radioactivity on equipment and other surfaces.

2. Applicability

This procedures applies a) when randomly sampling contamination levels on equipment and other surfaces, b) when sampling contamination levels at locations of suspected alpha, beta or gamma contamination on equipment or other surfaces.

3. Equipment

Basic:

a. Survey ratemeter or scaler/ratemeter

b. Pancake G-M detector

c. Sample holder (shielded)

d. Alpha, beta, and gamma check sources

e. Filter papers (Whatman 50 or equivalent)

f. Glassine or paper envelopes

g. Beta shield - minimum thickness 200 mg/cm^2

h. Radiation Contamination Survey Summary form

Site-specific:

a. ZnS alpha scintillation detector

b. Thin end-window G-M detector

c. Shielded sample holders

Gross determinations of alpha, beta and gamma contamination are effectively made using the pancake G-M detector. If separation of the beta and gamma components is desired, the beta shield can be used. The ZnS and end-window G-M detectors are useful in site situations where specific radionuclides are suspected and a more exact determination of contamination is necessary.

4. References

a. B.1 General Survey Guidelines

b. B.2 Background Measurements

c. Appendix C Reference Grid System Procedure

d. Instrument operation manuals

e. Table 19-4 Acceptable Contamination Limits

5. Operational Check

a. Adjust high voltage if necessary; attach pancake G-M detector to ratemeter.

b. Perform a battery check.

c. Inspect instrument for a current calibration label.

d. Record the background radiation measurement.

e. Set range to desired level based on previous operational check results for each check source.

f. Set response time to slow. When taking a measurement with a ratemeter, the detector is held in place long enough to accommodate the appropriate response time. When a scaler is used, count for at least one minute.

g. Check the response to all appropriate check sources by placing the source at the designated location on the detector. Record the net result (gross cpm - background cpm) for each check source on the appropriate Operational Check Log corresponding to the detector-ratemeter combination and compare with acceptable values. Instruments which do not respond appropriately are removed from service.

h. Repeat a. through g. above for the ZnS detector and alpha check source or the end window G-M detector and any appropriate check source, where necessary.

6. Procedure

a. Ensure that background measurements have been made as per Section B.2.

b. Background Determination

Background count rates are determined by placing unused filter paper into the shielded sample holder, and counting with the same detector and counting time as used during the smear sample counting procedure (see below).

c. Smear Sample Collection

i) Number the filter papers.

ii) Take a smear sample by wiping the numbered side of the filter paper over approximately 100 cm^2 of surface, using constant moderate pressure.

iii) Place the filter paper in an envelope.

iv) Record the smear sample information on the Radiation Contamination Survey Summary form and on the envelope.

v) Take additional smear samples to cover as much of the surface area in question as necessary.

d. Smear Sample Counting

i) To determine if transferable contamination is within acceptable limits, delay counting for at least four hours to allow decay of short-lived radionuclides. If swipe-testing for radon or thoron daughter products, the smears should be counted within 1-2 hours. If swipe-testing for decontamination purposes, the swipes may be counted immediately.

ii) Set range to the lowest level. The range will be adjusted any time a reading falls within 10% of either end of the scale.

iii) The smear is placed on the sample holder planchet and counted numbered side up.

iv) Gross measurements are recorded on the Radiation Contamination Survey Summary form. Data is corrected using the following, as applicable:

$$\text{dpm}/100\ \text{cm}^2 = \frac{\text{gross counts} - \text{background counts}}{\text{time (min)} \times \text{efficiency}}$$

Reduced data is recorded on the Radiation Contamination Survey Summary form, and in the field logbook as specified by the team leader.

RADIATION CONTAMINATION SURVEY SUMMARY

DATE _____

JOB #/FACILITY _____

GRID/MAP LOCATION _____

BLDG/ROOM _____

UNIT	INSTRUMENT		PROBE	
	TYPE	I.D. #	TYPE	I.D. #
A				
B				
C				
D				
E				

LOCATION			DIRECT PROBE MEASUREMENTS							REMOVABLE CONTAMINATION (SMEARS)				
			ALPHA (A)		BETA-GAMMA (B)		GAMMA (C)			ALPHA (D)		BETA-GAMMA (E)		
GRID BLOCK	GRID POINT	OTHER (REFERENCE CODE)	c/__m	dpm/100 cm^2	c/__m	dpm/100 cm^2	c/__m	uR/hr @ 1 meter	SMEAR #	c/__m	dpm/100 cm^2	c/__m	dpm/100 cm^2	
		BKG							BKG					

REMARKS _____

SURVEYORS (SIGNATURE) _____

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RADIATION SURVEY DATA

DATE _____

SURVEY PURPOSE _____

JOB: #/FACILITY _____

GRID/MAP LOCATION _____

BLDG/ROOM _____

UNIT	INSTRUMENT TYPE	INSTRUMENT I.D. #	PROBE TYPE	PROBE I.D. #
GAMMA SCINT				
A				
B:				

READING LOCATION (REFERENCE/ CODE)	GAMMA SCINT (cpm) 1 METER GROSS	GAMMA SCINT (cpm) 1 METER CORRECTED (dpm)	GAMMA SCINT (cpm) SURFACE GROSS	GAMMA SCINT (cpm) SURFACE CORRECTED (dpm)	A cpm ☐ mR/hr ☐ uR/hr ☐ GROSS	A CORRECTED (dpm ☐)	B: cpm ☐ mR/hr ☐ uR/hr ☐ GROSS	B: CORRECTED (dpm ☐)	REMARKS
BACKGROUND									

REMARKS _____

SURVEYORS (SIGNATURE) _____

APPENDIX E

PERSONNEL DECONTAMINATION PROCEDURES*

E.1 LOCALIZED SKIN DECONTAMINATION
E.2 HAIR AND SCALP DECONTAMINATION
E.3 GENERAL BODY DECONTAMINATION
E.4 FACIAL DECONTAMINATION
E.5 EYE OR EAR DECONTAMINATION
E.6 MOUTH DECONTAMINATION
E.7 NASAL DECONTAMINATION

*Adapted from Fundamentals of Health Physics for the Radiation Protection Officer, DARCOM-P 385-1, September 1983.

E.1 LOCALIZED SKIN DECONTAMINATION

Spot Decontamination

1. Press masking tape over the contaminated area.

2. Slowly remove and discard.

3. Repeat as necessary, avoiding skin irritation.

4. Proceed with area decontamination if tape method is not effective.

Area Decontamination (in increasing order of harshness)

1. Soap and water

   Use one or more of the following techniques until no further reduction in contamination occurs:

   a) Wash with mild bar soap and cool or lukewarm water.

   b) Wash with abrasive soap and water; this method is particularly applicable to toughened skin areas such as fingertips and the palms of the hands.

   c) Swab with mild liquid soap using cotton-tipped applicators, then rinse with water.

   d) Use a soft hand brush in combination with any of the above techniques.

   Consult with medical personnel before proceeding with harsher techniques.

2. Detergent and water

   a) Wash using a detergent and water.

   b) Make a paste by first lathering the skin area with mild soap and water, then applying detergent powder to lathered skin and working into a paste; rub skin area and rinse paste off.

3. Mild oxidizing agent

   Apply household bleach full strength using cotton sponges or applicators. Rinse after each application. Continue until no further contamination reduction occurs.

4. EDTA solution

   Prepare a 10% EDTA solution by dissolving 10 g of EDTA salts (Na_4EDTA) in 100 ml of water. (This solution can be prepared in advance and stored.) Apply the solution to the skin using cotton sponges. Rinse after application. **Do not apply more than two times.**

5. Strong oxidizing agent

   Prepare a saturated solution of potassium permanganate ($KMnO_4$) by dissolving $KMnO_4$ crystals in 1 ounce of water until no more crystals will dissolve (solution will be a dark red or brown). Prepare a saturated solution of sodium bisulfite ($NaHSO_3$) by dissolving $NaHSO_3$ crystals in 1 ounce of water until no more crystals will dissolve. Both these solutions can only be prepared onsite--they may not be prepared in advance and stored. Paint contaminated skin area with $KMnO_4$ solution using cotton applicators or sponges. Allow to dry, then repeat two more times. Remove brown stain by gently swabbing with $NaHSO_3$ solution using cotton swabs. Then rinse with water. If necessary, repeat the application one time only.

6. Further decontamination

   If contamination remains after all these procedures have been tried, a medical expert should be consulted for assistance.

7. Post-decontamination

   Following successful decontamination, apply hand lotion to skin to prevent chapping.

8. Sweating

   If soreness or tenderness develops during decontamination, the procedure being used should be stopped for a time. During this interval, the contaminated area can be covered with plastic and allowed to sweat, thus cleaning the area from the inside out. The area should then be gently washed in lukewarm water. (This method is particularly useful for decontaminating the hands, using disposable gloves for covering.)

E.2 HAIR AND SCALP DECONTAMINATION

1. Contaminated person should put on some clean protective clothing--coverall or Tyvek, gloves.

2. Wrap a towel around the person's neck.

3. Bend the person over a sink or basin and wash hair using mild soap or shampoo. Massage hair and scalp carefully,preventing lather or water from entering the ears, eyes, nose or mouth.

4. Rinse hair with water. Change the towel if it becomes saturated.

5. Thoroughly dry the hair with towels (do not use a blow dryer).

6. Resurvey hair, also checking face and neck.

7. Repeat shampoo process as long as it is effective.

8. If shampooing ceases to be effective, contaminated hair can be cut with scissors or clippers and the scalp can be decontaminated using the procedures for localized skin decontamination.

E.3 GENERAL BODY DECONTAMINATION

1. Remove clothing.

2. Shower with lukewarm water.

3. Lather, using mild soap and soft brush or scrub pad.

4. Rinse, taking care not to spread contamination to skin or body openings.

5. Survey and repeat as necessary.

6. If only localized contamination remains, follow procedures for localized skin decontamination.

E.4 FACIAL DECONTAMINATION

1. Use only mild soap and water to decontaminate the face. Avoid the use of oxidizing agents - they are too caustic to facial skin and are harmful to the eyes.

2. Exercise special caution to prevent the spread of contamination to eyes, ears, nose or mouth.

3. Take nasal smears to assess the presence of nasal contamination.

4. Contact medical personnel for assistance in treating persons with high levels of facial contamination or a suspected internal deposition of radioactivity.

E.5 EYE OR EAR DECONTAMINATION

Obtain assistance of medical personnel.

1. Flush with water. A fountain can be prepared by attaching a flexible tube to a faucet or water bottle.

2. Survey.

3. Repeat as necessary.

4. If eye becomes irritated or activity cannot be removed, obtain further medical assistance.

5. Fluids or agents other than water should not be used unless approved by medical personnel.

E.6 MOUTH DECONTAMINATION

Obtain assistance of medical personnel.

1. Special cautions:

   a) Under no circumstances should a person with mouth contamination be allowed to eat, drink, chew or use tobacco until decontaminated.

   b) In no cases shall oxidizing agents (bleach, potassium permanganate, sodium bisulfite) be used in the mouth because they will damage the mucous membranes.

2. Oral swipes may be taken prior to decontamination, and monitored on-site or sent out for laboratory analysis. Swipes sent out for analysis should be carefully identified with name, date, time, potential contaminants, and site location.

3. For localized mouth contamination (spot on tongue or tooth), swab with an applicator or cotton sponge.

4. For general mouth contamination, flush using tap water and a flexible tube connected to a faucet or water bottle (the fountain method).

5. If contamination cannot be effectively removed by flushing, further medical assistance should be obtained.

6. Bioassay should be initiated for individuals with mouth contamination.

E.7 NASAL DECONTAMINATION

Obtain assistance of medical personnel.

1. When nasal contamination is suspected, instruct individual not to inhale through nose.

2. Nasal smears should be taken before showering or extensive decontamination.

3. Nasal smears may be monitored on-site or sent out for laboratory analysis, depending on the extent of potential contamination. Smears sent for analysis should be carefully identified with name, date, time, potential contaminants, and site location.

4. Have the person blow nose into disposable tissue. Survey used tissue and nose.

5. Take smears externally on the nose and upper lip area using filter papers moistened with water.

6. Take smears inside each nostril using cotton-tipped applicators moistened with water.

7. Gently swab nasal passages using wet cotton applicators and periodically have the person blow nose into tissue.

8. If contamination is not removed, obtain further medical assistance in performing nasal irrigation.

9. Bioassay should be initiated for individuals with nasal contamination.

PERSONNEL RADIATION CONTAMINATION RECORD

NAME/EMPL # _____ LOCATION OF INCIDENT _____

DATE OF INCIDENT _____ TIME OF INCIDENT _____

JOB #/FACILITY _____

DESCRIPTION OF HOW CONTAMINATION OCCURRED _____

HOW WAS CONTAMINATION DISCOVERED? _____

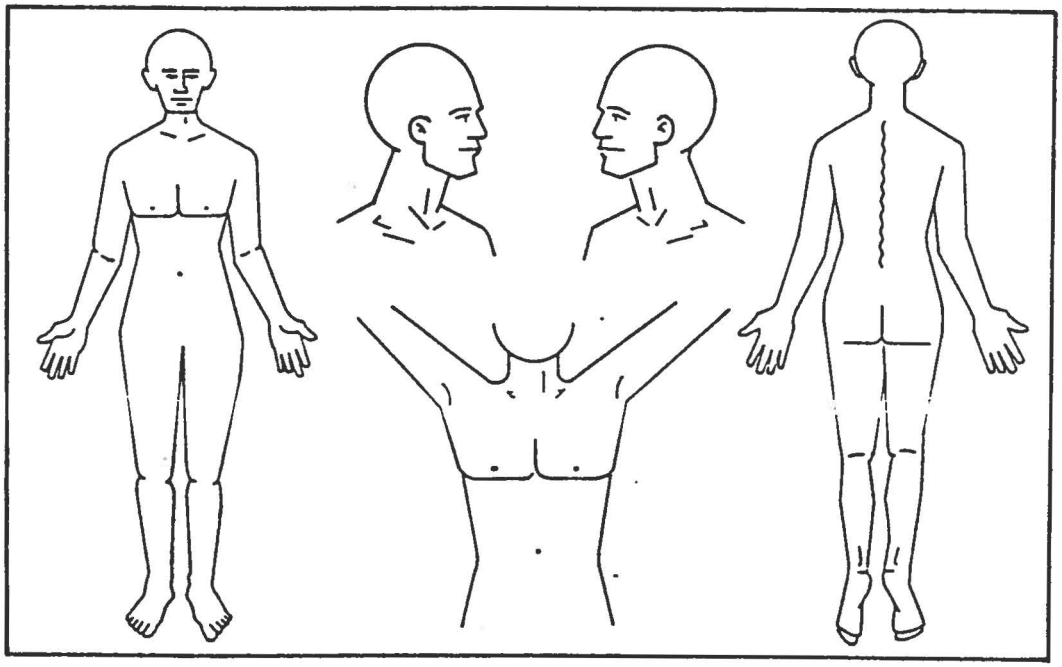
SURVEY RESULTS

BACKGROUND _____ cpm

INSTRUMENT TYPE/I.D. # _____

PROBE TYPE/I.D. # _____

INDICATE TYPE, EXTENT AND MAGNITUDE (GROSS cpm) OF CONTAMINATION ON FIGURE BELOW.



CALCULATE AVERAGE dpm/100 cm^2 AND FILL IN NEXT TO APPROPRIATE GROSS MEASUREMENTS.

RSO (SIGNATURE) _____

SURVEYORS (SIGNATURE) _____

CDHS REVIEW _____

574107

PERSONNEL RADIATION DECONTAMINATION LOG

NAME/EMPL # _____ DATE _____

TIME _____ BACKGROUND _____ cpm

JOB #/FACILITY _____

INITIAL CONTAMINATION LEVEL cpm	INITIAL CONTAMINATION LEVEL dpm/100cm^2	BODY AREA

TIME DECONTAMINATION BEGINS	BODY AREA CONCERNED	DECONTAMINATION AGENT USED	CONTAMINATION LEVEL AFTER DECONTAMINATION (dpm/100 cm^2)	SKIN CONDITION

DECONTAMINATION COMPLETED BY _____ TIME _____

IS ALL CONTAMINATION REDUCED TO ACCEPTABLE LEVELS? YES ___ NO ___
IF NOT, EXPLAIN BELOW.

BIOASSAY RECOMMENDED

- ☐ IN-VIVO COUNT
- ☐ FECES SAMPLE
- ☐ URINE SAMPLE
- ☐ NONE REQUIRED
- ☐ NASAL/ORAL SWIPE
- ☐ OTHER (SPECIFY) _____

FOLLOW UP

FURTHER EVALUATION NEEDED? YES ___ NO ___

MEDICAL ASSISTANCE REQUIRED? YES ___ NO ___

INDIVIDUAL SENT TO _____
(MEDICAL FACILITY)

COMMENTS

_____

_____

_____

_____

RSO (SIGNATURE) _____

DECONTAMINATED PERSONNEL (SIGNATURE) _____

CDHS REVIEW _____

575107

Figure 19–3 PERSONNEL RADIATION DECONTAMINATION LOG

Nuclide	Historical name	Half-life	Major radiation energies (MeV) and intensities† α	β	γ
$^{238}_{92}U$	Uranium I	4.51×10^{9}y	4.15 (25%) 4.20 (75%)	---	---
$^{234}_{90}Th$	Uranium X_1	24.1d	---	0.103 (21%) 0.193 (79%)	0.063c‡ (3.5%) 0.093c (4%)
$^{234}_{91}Pa^{m}$	Uranium X_2	1.17m	---	2.29 (98%)	0.765 (0.30%) 1.001 (0.60%)
99.87% | 0.13%					
$^{230}_{91}Pa$	Uranium Z	6.75h	---	0.53 (66%) 1.13 (13%)	0.100 (50%) 0.70 (24%) 0.90 (70%)
$^{234}_{92}U$	Uranium II	2.47×10^{5}y	4.72 (28%) 4.77 (72%)	---	0.053 (0.2%)
$^{230}_{90}Th$	Ionium	8.0×10^{4}y	4.62 (24%) 4.68 (76%)	---	0.068 (0.6%) 0.142 (0.07%)
$^{226}_{88}Ra$	Radium	1602y	4.60 (6%) 4.78 (95%)	---	0.186 (4%)
$^{222}_{86}Rn$	Emanation Radon (Rn)	3.823d	5.49 (100%)	---	0.510 (0.07%)
$^{218}_{84}Po$	Radium A	3.05m	6.00 (~100%)	0.33 (~0.019%)	---
99.98% | 0.02%					
$^{214}_{82}Pb$	Radium B	26.8m	---	0.65 (50%) 0.71 (40%) 0.98 (6%)	0.295 (19%) 0.352 (36%)
$^{218}_{85}At$	Astatine	~2s	6.65 (6%) 6.70 (94%)	? (~0.1%)	---
$^{214}_{83}Bi$	Radium C	19.7m	5.45 (0.012%) 5.51 (0.008%)	1.0 (23%) 1.51 (40%) 3.26 (19%)	0.609 (47%) 1.120 (17%) 1.764 (17%)
99.98% | 0.02%					
$^{214}_{84}Po$	Radium C'	164μs	7.69 (100%)	---	0.799 (0.014%)
$^{210}_{81}Tl$	Radium C"	1.3m	---	1.3 (25%) 1.9 (56%) 2.3 (19%)	0.296 (80%) 0.795 (100%) 1.31 (21%)
$^{210}_{82}Pb$	Radium D	21y	3.72 (.0000002%)	0.016 (85%) 0.061 (15%)	0.047 (4%)
$^{210}_{83}Bi$	Radium E	5.01d	4.65 (.00007%) 4.69 (.00005%)	1.161 (~100%)	---
~100% | .00013%					
$^{210}_{84}Po$	Radium F	138.4d	5.305 (100%)	---	0.803 (0.0011%)
$^{206}_{81}Tl$	Radium E"	4.19m	---	1.571 (100%)	---
$^{206}_{82}Pb$	Radium G	Stable	---	---	---

*This expression describes the mass number of any member in this series, where n is an integer.
Example: $^{206}_{82}Pb$ (4n + 2).....4(51) + 2 = 206

†Intensities refer to percentage of disintegrations of the nuclide itself, not to original parent of series.

‡Complex energy peak which would be incompletely resolved by instruments of moderately low resolving power such as scintillators.

Data taken from: Table of Isotopes and USNRDL-TR-802.

Figure 3–7 URANIUM SERIES (4n + 2)*